TRIM PANEL WITH INTEGRALLY FORMED ATTACHMENT MEMBER

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The inventions relates in general to the attachment of an accessory to a trim panel, and in particular to a trim panel with an integrally formed attachment member for mounting an acoustic device, such as a loudspeaker, an exciter, a piezoelectric transducer or the like, to the trim panel.

Description of the Related Art

[0002] An acoustic device, such as an electrodynamic exciter, applies bending wave energy to a trim panel to cause the trim panel to resonate and produce an acoustic output. Typically, the exciter comprises a magnet assembly rigidly fixed to a housing to define an annular gap, and a voice coil and coil former assembly disposed in the annular gap and rigidly fixed to the trim panel near to the geometric center thereof.

[0003] Typically, the acoustic device is mounted to the trim panel by using a separate mounting member, such as a mounting plate, that is fixedly attached to the trim panel using one or more fasteners, such as screws, or the like. After the separate mounting member is fixedly attached to the trim panel, such as by bonding, the acoustic device can be attached to the trim panel. However, the need for a separate mounting member and the time required to fixedly attach the separate mounting member to the trim panel increases the overall cost associated with mounting the acoustic device to the trim panel.

SUMMARY OF THE INVENTION

[0004] The inventors of the present invention have recognized these and other problems associated with a separate mounting member and the additional step necessary for fixedly attaching the separate mounting member to the trim panel. To this end, the inventors have developed a trim panel with an integrally formed attachment member for mounting an acoustic device, such as a loudspeaker, an exciter, a piezoelectric transducer, or the like, directly to the trim panel without the need of a separate mounting member. The acoustic device is attached to the trim panel by using a twist and lock fastening feature in the form of an attachment member with a ramp surface that draws the acoustic device

toward the trim panel as the acoustic device is rotated about the attachment member. Once the acoustic device is rotated into place, one or more detents are provided on the trim panel and corresponding one or more corresponding recesses are provided on the acoustic device to lock the acoustic device securely in place.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] In the drawings:

[0006] Fig. 1 shows a front perspective view of a trim panel with an integrally formed attachment for mounting a loudspeaker according to an embodiment of the invention;

[0007] Fig. 2 shows a rear perspective view of the trim panel of Fig. 1; and

[0008] Fig. 3 shows a cross section view of the trim panel of Fig. 1 taken along line 3-3 of Fig. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0009] Referring to Figs. 1-3, a trim panel 10 includes an inner surface 11 and an outer surface 12. The trim panel 10 may be in the form of a vehicular headliner, door panel, valence panel, dashboard, package tray, or the like. For example, in the illustrated embodiment, the trim panel 10 may form a door panel in which the inner surface 11 forms a Class "B" surface that faces away from the interior of the vehicle and is not visible to the occupants, and the outer surface 12 forms a Class "A" surface that faces the interior of the vehicle and is visible to the occupants.

[0010] The trim panel 10 includes an attachment member 14 for attaching an acoustic device 16, such as a loudspeaker, an exciter, a piezoelectric transducer, or the like, to the trim panel 10. One aspect of the invention is that the attachment member 14 is integrally formed with the trim panel 10 using known molding techniques, such as injection molding, or the like. For example, the attachment member 14 can be integrally formed with the trim panel 10 by using slides in a mold tool (not shown) that forms the trim panel 10. Preferably, the attachment member 14 is integrally formed with the trim panel 10 at a location of the trim panel 10 that has a substantially flat topography to accommodate the substantially flat profile of the acoustic device 16. However, the invention can be practiced at other locations of the trim panel that do not have a substantially flat topography.

[0011] Another aspect of the invention is that integrally formed attachment member 14 enables the inner and outer surfaces 11, 12 to be generally continuous, unlike conventional mounting systems in which an opening may be necessary for mounting the acoustic device 16.

[0012] In the illustrated embodiment, the attachment member 14 includes a pair of opposing, substantially identical mounting portions 18. Each mounting portion 18 is substantially arcuate in shape having a lower mounting portion 20 and an upper mounting portion 22. The lower mounting portion 20 has a greater width or radial thickness than the upper mounting portion 22 such that a ledge 24 is formed in the upper surface of the lower mounting portion 20, as best seen in Figs. 2 and 3. The upper mounting portion 22 projects outwardly substantially perpendicular to the inner surface 11 of the trim panel 10, whereas the lower mounting portion 20 projects outwardly substantially perpendicular to the upper mounting portion 22.

[0013] As best seen in Fig. 3, the ledge 24 of one of the mounting members 18 is separated from the inner surface 11 at a first distance, d_1, and the ledge 24 of the other one of the mounting members 18 is separated from the inner surface 11 at a second distance, d_2. In the illustrated embodiment, the distance, d_1, is greater than the distance, d_2, such that the ledges 24 provide a ramp surface to move the acoustic device 16 toward the trim panel 10 when the acoustic device 16 is rotated in a first direction about the vertical axis, V. On the other hand, the ramp surface causes the acoustic device 16 to move away from the trim panel 10 when the acoustic device 16 is rotated in a second direction that is opposite to the first direction. While the illustrated embodiment shows a pair of substantially identical opposing mounting members 18, it will be appreciated that the invention can be practiced with any desired number of mounting members, for example, a single mounting member forming an uninterrupted mounting member having a circular shape. The mounting member 18 also includes a pair of detents 26 for locking the acoustic device 16 in place.

[0014] Referring now to Figs. 2 and 3, the acoustic device 16 includes a substantially planar upper surface 28 and an opening 30 for mounting the acoustic device 16 to the attachment member 18. The upper surface 28 includes a pair of opposing detent grooves or recesses 32 capable of receiving the detents 26 integrally formed in the trim panel 10 to lock the acoustic device 16 in place. The opening 30 in the upper surface 28 of the acoustic

device 16 is approximately the same dimension as the distance between the outer surfaces of the upper mounting portions 22, as indicated by the dashed lines in Fig. 3. The opening 30 also includes a pair of cutouts 34 for allowing the acoustic device 16 to be inserted over the lower mounting portions 20 of the attachment member 18.

[0015] To install the acoustic device 16 to the trim panel 10, the acoustic device 16 is aligned with the attachment member 18 such that the cutouts 34 are directly over the lower mounting portions 20. Then, the acoustic device 16 is moved toward the attachment member 18 until the lower mounting portions 20 are received within the cutouts 34. Next, the acoustic device 16 is rotated in a first, counterclockwise direction to move the acoustic device 16 toward the trim panel 10. The acoustic device 16 is rotated until the upper surface is in close proximity to the trim panel 10 and the detents 26 are received in the detent grooves or recesses 32 to lock the acoustic device 16 in place. When the detents 26 are received in the detent grooves 32, the cutouts 34 are not positioned over the lower mounting portions 24 of the attachment member, as shown in Fig. 2. To remove the acoustic device 16, the acoustic device 16 is rotated in a second, clockwise direction.

[0016] As described above, the acoustic device 16 is attached to the trim panel 10 by use a twist and lock fastening feature in the form of the attachment member 18 with a ramp surface that draws the acoustic device 16 toward the trim panel 10 as the acoustic device 16 is rotated about the attachment member 18. In addition, the integrally formed attachment member 18 does not require a separate mounting plate for mounting the acoustic device 16 to the trim panel, unlike conventional mounting devices, thereby eliminating the need for holes in the trim panel for attaching the separate mounting plate to the trim panel. Thus, the integrally formed attachment member 18 provides a more aesthetic Class "A" surface than conventional attachment members.

[0017] While the invention has been specifically described in connection with certain specific embodiments thereof, it is to be understood that this is by way of illustration and not of limitation, and the scope of the appended claims should be construed as broadly as the prior art will permit.